ESTIMATION OF CROWN-RUMP LENGTH FROM EXTERNAL SURFACE AREA OF RIGHT FRONTAL BONE

Vandana Jain¹, Sheenu Malik Suri², Arvind Jain³, Anjali D. Patil⁴, Swati Pandhare⁵

HOW TO CITE THIS ARTICLE:

Vandana Jain, Sheenu Malik Suri, Arvind Jain, Anjali D Patil, Swati Pandhare. "Estimation of crown-rump length from external surface area of right frontal bone". Journal of Evolution of Medical and Dental Sciences 2013; Vol2, Issue 36, September 9; Page: 6927-6932.

ABSTRACT: The present study aimed to establish the correlation between the external surface area of right frontal bone and crown rump length and hence predict the approximate fetal age from the crown rump length. Simultaneously growth pattern and rate of growth of frontal bone could be calculated. Fifty apparently normal fetuses ranging from 12 cm – 42 cm crown rump length of both sexes were obtained from the department of obstetrics and gynecology, Sassoon Hospital Pune. The foetuses were macerated to isolate the right frontal bone. The bone was subsequently cleaned and dried. The external surface area was measured. These measurements were tabulated and statistically analysed. A linear correlation was observed between the external surface of frontal bone & the crown rump length.

KEY WORDS: Crown-rump length, Frontal bone, External surface area, Growth rate.

INTRODUCTION: The skull is composed of the neurocranium which surrounds the brain, eyes and inner plus middle ears, and the viscerocranium which is derived from the frontonasal and first arch mesenchyme and forms the facial skeleton. The whole of the viscerocranium is neural crest-derived; the neurocranium (skull vault and the skull base) is derived from mesenchyme of both neural crest and mesodermal origin¹. Apart from the classic work of Scammon and Calkins² very few studies have been concerned specifically with human prenatal cephalometrics. Hence the study aimed at deriving a Regression equation to estimate the crown- rump length and the approximate age of foetus.

MATERIAL AND METHODS: Human fetuses for the purpose of the present work were collected from the Department of obstetrics and gynecology in Sassoon Hospital, Pune. The fetuses were obtained from Medical Termination of Pregnancy done for various reasons. Fresh fetuses which appeared to be normal were selected for the present study. Skull bones from the fetuses were obtained after maceration, cleaning & drying. Wet thin cotton cloth was pasted on the external surface of individual skull bones. The cloth was accurately trimmed to the tune of the bone margins. The cloth was then detached from the bone and spread out on a graph paper. Then an outline was drawn along the margins of spread cotton piece over the graph paper. Area under the graph was then calculated

RESULT: Surface area of right frontal bone from minimum to maximum range was 5.24 – 37.3 sq cm with mean surface area 18.72 sq cm .The correlation coefficient (r) for right frontal bone was calculated (table no.2) and is equal to 0.916. The regression equation of CR length and right parietal i.e. y on x is thus calculated and given by following equation $Y = 9.61 + 0.76 \times X$

With the help of above regression equation the crown rump length was worked out for surface area of right frontal bone from minimum to maximum range of the sample obtained. The

straight line regression was plotted on graph paper (graph no.1). The regression values were plotted in the graph and these values were found to cluster around the standard straight line and were in hand with the straight line indicating highly significant results.

Z test was calculated for assessing the significance level. There was highly significant correlation between CR length and surface area of right Frontal bones i.e. P- value - < 0.0001.

GROWTH RATE: At mean crown-rump length of 14.5cm mean frontal area was 7.68 sq cm. From 14.5-19.5 cm range, 1 cm increase in CR length there was an increase of Right frontal area by 0.994 sq.cm. From 19.5-24.5 cm range, with 1 cm increase in CR length, increase of frontal area was found to be 1.364 sq.cm. From range of 24.5-29.5cm CR length, 1cm increase in CR length increase of frontal area occurred by 1.16 sq.cm. From 29.5-34.5cm range of CR length, 1cm increase in CR length increased frontal area by 0.982 sq.cm. From range of 34.5-39.5 cm CR length, 1cm increase in CR length the frontal area increased by 0.562 sq.cm.

DISCUSSION: In our present study, linear relationship between external surface area of right frontal bone and CR length and hence foetal age could be determined using Streeters equation (1920)³. In our study instead of circumference and diameter of skull bones, surface area was used as a dimension for calculation of CR length. In present study 'Z' test was used.

Kharkar A. R, (1993)⁴ studied CR length from external surface area of frontal bone and found a linear correlation between the external surface area of frontal bone and CR length. Their study found the regression equation for frontal bone as follows.

$X=Y+2.61/0.78$. They used "chi" square test for assessing the levels of significance and found a significant correlation.

Kulkarni P.Y and Zambare, B.R (2006)⁵ found a definite correlation between surface area of frontal bone and CR length. The regression equation for calculation of CR length was- $X=Y+14.7731/1.37$. Paired "t" test was used and found to be statistically significant.

The most widely used , and most useful , index of growth of the crown-rump length, and an estimate of age can be obtained by relating the length to a standard curve, such as that published by Boyd, E (1941)⁶

Gary, S. Berger, Edelman Davida. A and Kerenyi, T.D (1975)⁷ also reported linear co relationship between foetal size (crown-rump length and Biparietal diameter) and gestational age in second trimester of pregnancy.

Various attempts have been made by different workers (Dupertuis and Hadden, (1951)⁸; Trotter and Gleser, (1958)⁹; Kate and Majumdar, (1976)¹⁰ to bring out formulae to derive stature and to estimate the age on the basis of availability of the bone remains.

REFERENCES:

1. Grays Anatomy, The anatomical basis of clinical practice, 39th edn. Patricia Collins E. L. B. S. Churchill Livingstone. Chapter 26 pg 446.
2. Scammon, R.E and Calkins, L.A. The development and growth of the external Dimensions of the Human Body in the fetal period. Minneapolis, University of Minnesota Press. (1929)

ORIGINAL ARTICLE

3. Streeter, G.L Developmental horizons in human embryos (fourth issue). A review of the histogenesis of cartilage and bone. Contrib. Embryol., 33(220): 149-167. Publication no. 583, Carnegie Institution of Washington.(1949)
4. Kharkar, A.R. Estimation of crown-rump length of foetus from external surface area of frontal bone. Anat. Adj, 1 (12) 35- 40 (1993)
5. Zambare B.R. and Kulkarni P.Y - Estimation of crown-rump length from external surface area of Frontal and Parietal skull bones. J Anat soc India 55 (1) 37-41(2006).
6. Boyd E.. Outline of physical growth and development. Burgess, Minneapolis (1941)
7. Gary, S.B., Edelman, D.A. and Kerenyi, T.D. Foetal crown-rump length and biparietal diameter in the second trimester of pregnancy. Am. J. Obstet. Gynecol, 122 (1). 9-12 (1975).
8. Dupertuis. C.W and Hadden.J. A.Jr. On the reconstruction of stature from long bones. Am.J.Phy. Anthropology, 9; 15-54, (1951).
9. Trotter, M and Gleser, G.CA revaluation of estimation of stature based on measurements of stature taken during life and of long bones after death. Am.J.Phy. Anthropol., n.s., 16; 79-123, (1958).
10. Kate, B.R. and Majumdar,R.D. Stature estimation from femur and humerus by regression and autometry. Acta. Anat., 94; 311-320, (1976).

CRL (cm)	No of cases	Mean CRL (cm)	Mean Frontal area right (Min, Max.) sq. cm
12 – 17	9	13.41	7.68 (5.24 – 10.99)
17.1 – 22	11	18.94	12.65 (7.23 – 20.21)
22.1 – 27	13	24.18	19.47 (14.34 – 32.22)
27.1 – 32	9	29.1	25.27 (18.63 – 32.74)
32.1 – 37	6	34.58	30.18 (26.49 – 37.3)
37.1 – 42	2	37.65	32.99 (32.78 – 33.2)
Total	50	23.76	18.72 (5.24 – 37.3)

Table 1: Showing minimum, maximum and mean surface area of right frontal bone

Correlation between	r	P Value
CRL (Cms) & (F1) Right (Cm ²)	0.916	<0.0001

Table 2: Correlation between CRL and (F1) Right Frontal bone

$$Y = 9.61 + 0.76 \times X$$

ORIGINAL ARTICLE

GRAPH:

BAR CHART:

1. Rt FRONTAL BONE
(MARKED)

2. Rt FRONTAL BONE
(with cotton cloth pasted)

3. DRAWING THE MARGINS
(with cotton cloth pasted over graph

4. GRAPH PAPER SHOWING SURFACE AREA (Rt frontal bone)

AUTHORS:

1. Vandana Jain
2. Sheenu Malik Suri
3. Arvind Jain
4. Anjali D Patil
5. Swati Pandhare

PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Anatomy, Mahatma Gandhi Memorial Medical College, Indore.
2. Assistant Professor, Department of Anatomy, Mahatma Gandhi Memorial Medical College, Indore.
3. Assistant Professor, Department of Conservative Dentistry & Endodontics, Govt Dental College, Indore

4. Associate Professor, Department of Anatomy, B.J. Medical College & Sassoon General Hospital, Pune.
5. Assistant Professor, Department of Anatomy, B.J. Medical College & Sassoon General Hospital, Pune.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Vandana Jain,
77, Utkarsh Estate, Nr. Bengali Square,
Indore – 452016.
Email- docvandanajain@gmail.com

Date of Submission: 22/08/2013.
Date of Peer Review: 23/08/2013.
Date of Acceptance: 02/09/2013.
Date of Publishing: 04/09/2013